

Notes on the Naidiform Oligochæta; containing a Description of New Species of the Genera *Pristina* and *Pterostylarides*, and Remarks upon Cephalization and Gemmation as Generic and Specific Characters in the Group.

By

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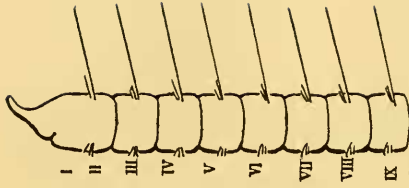
With Plates XXVI and XXVII.

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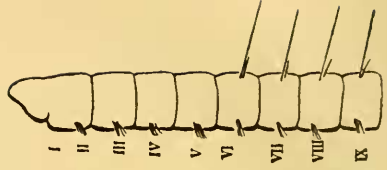
THESE notes were commenced at the instigation of Professor Lankester in 1882, to whom the late Mr. Thomas Bolton had forwarded specimens of a Naid which Professor Lankester identified as the *Nais littoralis* of O. F. Müller, together with another Annelid which I subsequently described as *Haplobranchus æstuarinus*.

Professor Lankester kindly placed in my hands all his drawings and notes relating to Naid; and those on *Nais* (*Paranais*) *littoralis* and *Pterostylarides macrochæta*, to each of which he had devoted considerable attention, are made use of in this paper.

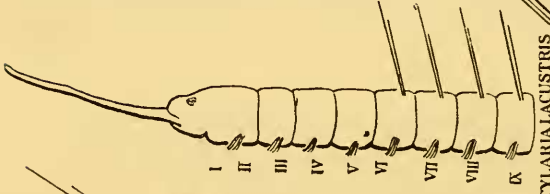
To Mr. Bolton I was indebted for a very large number of Naid; collected in all parts of England, and I had intended to prepare a monograph on the British species of this group, but I left England with a series of scattered notes and half-finished drawings. Vejdovsky, in his magnificent 'System und Morphologie der Oligochaeten,' brought together his own researches and a summary of our knowledge



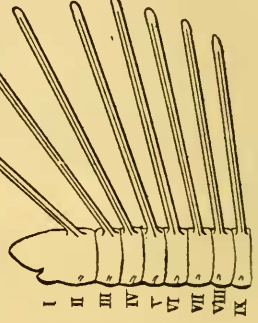
PRISTINA EUISETA



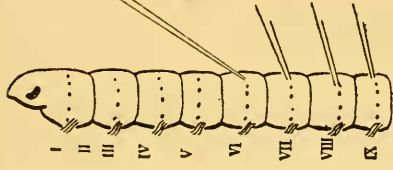
DERO SP



STYLARIA LACUSTRIS



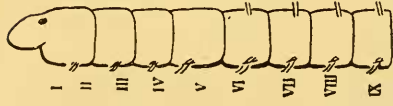
CLITOBANCHIUS SEMPER



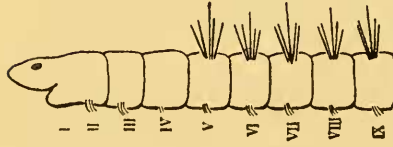
SLAVINA SP



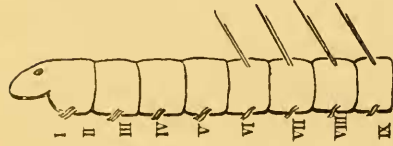
PARANAIS LITTORALIS.



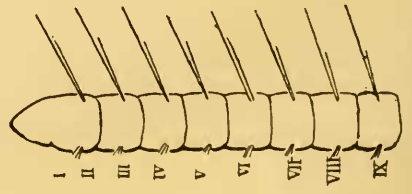
OPHIDONAIIS SERPENTINA



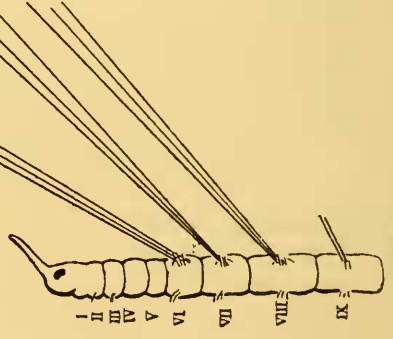
UOBEMILLA COMATA



NAIS SP



NAIDIUM LUTEUM



PTEROSTYLARIDES MACROCHAETA

of the group; and Mr. E. C. Bousfield<sup>1</sup> has still more recently in a valuable paper given a systematic account of the various species of the genus *Dero* at present known.

I am induced, even after this lapse of time, to publish some of my uncompleted notes, partly because no one has since described the new species which were discovered by Professor Lankester and myself,<sup>2</sup> and partly because no writer on the group has adequately dealt with the importance of the number of cephalized segments as a generic character.

A monograph of the British species is still a desideratum. I received from Mr. Bolton on several occasions specimens other than those herein described, which were certainly not referable to any existing species, but for which my notes are insufficient to warrant the creation of new species. It has frequently been pointed out, but very little stress has been laid upon the fact even by Vejdovsky,<sup>3</sup> that the dorsal setæ are often wanting in several of the anterior segments of the body, while ventral setæ are present in these segments. It is this character which chiefly marks what I term, at Professor Lankester's suggestion, a cephalization. There is almost always, if not always, a certain amount of cephalization in the Oligochæta; that is to say, there is in the anterior region a segment or number of segments which differ in their organization from the segments which follow, these latter being usually similarly developed throughout the remainder of the worm. This may be exhibited by peculiarities of the alimentary canal, the circulatory system, the arrangement of septa, the absence of nephridia from the most anterior segments, and so on. In most if not all Oligochæta there is a peristomial segment which is devoid of any setæ, and in many Nuids the dorsal setæ are absent from three, four, or six of the

<sup>1</sup> 'Journ. Linn. Soc. Zoology,' vol. xx, 1887, p. 91.

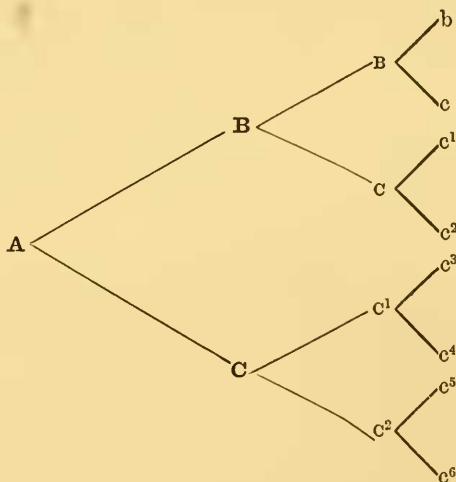
<sup>2</sup> Professor Lankester referred to *Pterostylarides macrochæta* (under the name of *Pterygonais macrochæta*) and exhibited my drawing of this worm, which is here published, at the meeting of the British Association at Southport in 1883.

<sup>3</sup> 'Oligochaeten,' 1884.

segments immediately following the peristomial segment; and, moreover, the number of segments thus modified (cephalized) appears to be constant in all the species of a genus.<sup>1</sup> The accompanying woodcut shows the various generic types.

The laws which govern gemmation or budding were worked out by Semper. I have added the following remarks upon the subject with the view of making this somewhat complicated matter clearer to English readers, in the hope that some microscopist may be induced to make further observations on the subject in species where we still lack information as to the budding individuals. There are many such, but there are an even greater number of species in which the sexual individuals have never been seen.

In the following diagram—



<sup>1</sup> The only recorded exception to this which I have found is given by Bousfield (l. c.), who states that in *D. furcata* there are only four segments destitute of dorsal setæ, while in all other species there are five such segments. I may, however, point out that *D. furcata* differs in another marked character from all other known species of *Dero* in the possession of "palpi," and should, I expect, be therefore placed in another genus.

**A** is a primary zoöid developed from the egg. **A** will give rise to two secondary zoöids, **B** and **C**, in the following manner:—after its  $n^{\text{th}}$  segment ( $n$  is a number characteristic probably of each species) a bud, **Z**, will form; this will divide into two regions,  $z$  and  $z'$ :  $z$  will consist of an indefinite number of segments, and form the tail of **B**; while  $z'$  will consist of a definite number of segments (a number characteristic of each genus), and will become the head of **C**.

**B** and **C** may now separate, or may remain joined together until two new budding regions have appeared.

In either case, after the  $n^{\text{th}}$  segment of **B** another bud, **Z**, may form, which will behave in the same way as the first bud behaved, and divide into  $z$  and  $z'$ ; and  $z$  will become the tail of a tertiary zoöid **B**; and  $z'$  the head of another tertiary zoöid, **c**; and a similar process will take place after the  $n^{\text{th}}$  segment of **C**, giving rise to two other tertiary zoöids,  $c^1$  and  $c^2$ . The chain of four zoöids represented by the letters **B**, **c**,  $c^1$ ,  $c^2$ , may now separate into two chains of two zoöids each, **bc** and  $c^1c^2$ , or so far as we know may remain joined together until, by the formation of four new budding regions, a chain of eight zoöids, **b**, **c**,  $c^1$ ,  $c^2$ ,  $c^3$ ,  $c^4$ ,  $c^5$ ,  $c^6$ , has developed. As a matter of fact I believe that in no Naid do more than four zoöids hang together in a chain.

Among a mass of Naids where asexual reproduction was rife, specimens might occur which could be represented thus:—**A**, **B**, **C**, **BC**, **B**, **c**,  $c^1$ ,  $c^2$ , **bc**,  $c^1c^2$ , **b**, **c**,  $c^1$ ,  $c^2$ ,  $c^3$ ,  $c^4$ ,  $c^5$ ,  $c^6$ , **bc**,  $c^1c^2$ ,  $c^3c^4$ ,  $c^5c^6$ ,  $bcc^1c^2$ ,  $c^3c^4c^5c^6$ , &c.

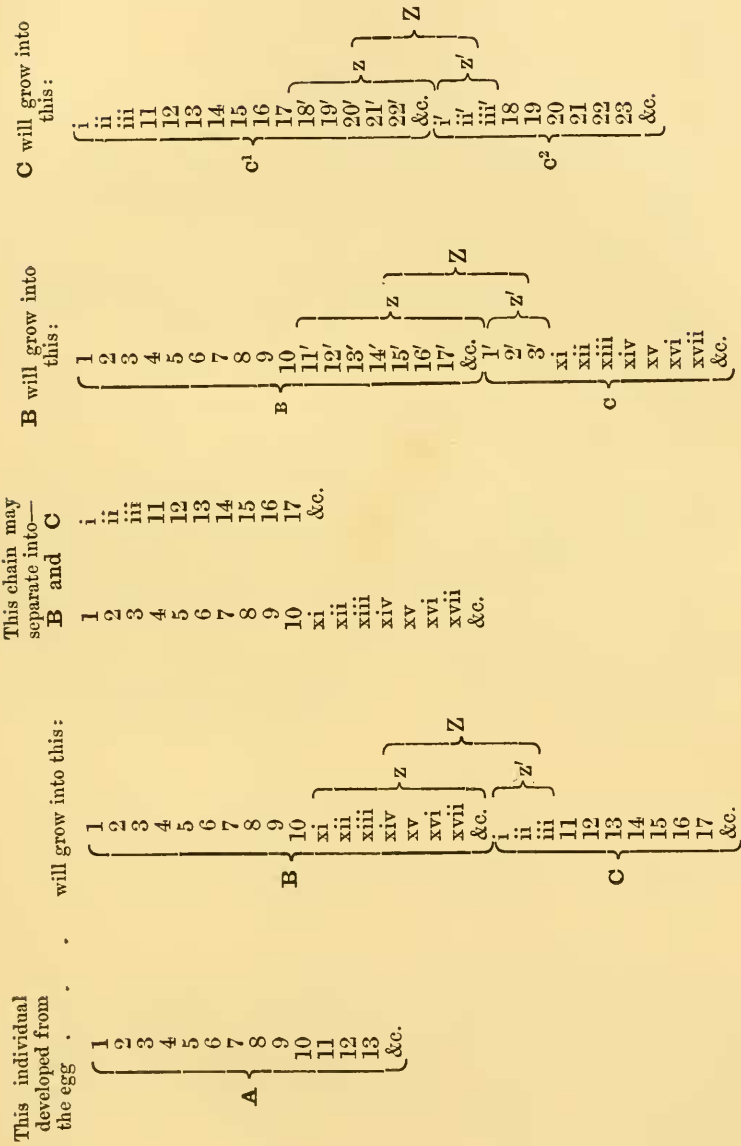
I am inclined to believe that the forms which do occur are **A**, **BC**, **bc**,  $c^1c^2$ ,  $bcc^1c^2$ ,  $bcc^1c^2$ ,  $c^3c^4c^5c^6$ , &c.; and among these we may theoretically recognise three types:—(1) forms **A**, developed from the egg; (2) forms **BC**,  $bcc^1c^2$ ,  $bcc^1c^2$ , &c., in which the original head end is retained; and (3) forms  $c^1c^2$ ,  $c^3c^4c^5c^6$ , &c., in which the head is a budded region; and it is possible that there are forms **C**, which must be distinguished from  $c^1c^2$ ,  $c^3c^4c^5c^6$ , &c., as they possess the tail end of a form **A**, while  $c^1c^2$  and  $c^3c^4c^5c^6$  must consist entirely of segments formed by budding.

I am not aware that any of these forms can be distinguished from one another by observation of their structure, but it would be most interesting to discover whether all or some of them only can become sexual individuals.

I believe that the number of segments in the sexual individual is constant for the species, while that in asexual individuals is indefinite; but that  $n$  is a number constant for the species, and that the number of segments in  $z'$  is constant for the genus,  $n$  and  $z'$  being used with the signification above described.

The segments represented by  $z'$  are referred to in the generic definitions as the cephalized segments: in most cases all these cephalized segments remain marked in the adult; in all cases the most anterior of them, the peristomial segment, is obvious, while the others are usually marked by the non-development of dorsal seta bundles; but in *Pristina*, at any rate, the bud shows that there are really seven cephalized segments (*i. e.*  $z'$  consists of seven segments), a fact which could not be ascertained by an inspection of the well-grown head region.

The following table represents six zoöids or chains of zoöids belonging to the same species, an imaginary species in which I have supposed  $n=10$ , and  $z'$  to consist of three segments; all the other letters have the signification above described. Instead of actually drawing the segments I have represented them by some numeral.



## SYSTEM OF THE NAIDOMORPHA.

The Naidomorpha are Oligochæta in which the central nervous system presents cerebral ganglia, pharyngeal commissures, and a ventral cord. The cerebral ganglia are always separated from the epiblast.

In addition to sexual, asexual reproduction by means of gemmation and subsequent fission occurs. A clitellum develops in sexual individuals at the breeding season.

The setæ are placed in four rows. They are capillary, spear-shaped, or crotchet-shaped.<sup>1</sup>

There are, as a rule, more than two setæ in each bundle.

A stomachal enlargement of the alimentary canal occurs in segment VII or VIII. They are all aquatic, living in fresh or sea water. Branchial processes may be present or absent.

To this definition must be added, when information is available, the position of the various generative organs. The position of the testes and ovaries given by Vejdovsky does not agree with my observations on *N. barbata* and *P. littoralis*.

According to Vejdovsky, the following genera form the family of Naidomorpha :—

*Aulophorus*, Schmarda.

*Dero*, Oken.

*Nais*, s. str., O. F. Müller.

*Bohemilla*, Vejdovsky.

*Ophidonais*, Gervais.

<sup>1</sup> I do not use these three terms to correspond exactly to Haar-borsten, Spalt-borsten, and Haken-borsten. The capillary setæ are the long hair-like setæ, which may be serrated as in *Bohemilla*; the crotchet-shaped setæ have the well-known *f*-shape, with the forked free extremity; while what I have called spear-shaped setæ are such setæ as present characters to some extent intermediate between those of the foregoing types. They may be straight with a sharp-pointed end, or straight and bifurcated at the end, or somewhat crook-shaped.



Slavina, Vejdovsky.  
 Stylaria, Ehrenberg.  
 Pristina, Ehrenberg.  
 Naidium, O. Schmidt.

I think it is desirable to add to this list *Pterostylarides*, Czerniavsky, for *P. parasita* (syn. *Stylaria parasita*, O. Schmidt) and *P. macrochæta*, sp. n., mihi; Paranais, Czerniavsky, for *P. littoralis* (syn. *N. littoralis*, O. F. Müller) and ? *P. uncinata*, and *Chætobranchus*, for *C. semperi*, mihi.

#### GENERA AND SPECIES OF NAIDOMORPHA.

##### *Aulophorus*, Schmarda.

1. *A. discocephalus*, Schmarda; Kingston, Jamaica.
2. *A. oxycephalus*, Schmarda; Galle, Ceylon.
3. *A. vagus*, Leidy; Philadelphia, N. America.

##### *Dero*, Oken (see woodcut).

1. *D. latissima*, Bousfield.
2. *D. Perrieri*, Bousfield.
3. *D. obtusa*, D'Udekem.
4. *D. limosa*, Leidy.
5. *D. philippinensis*, Semper.
6. *D. acuta*, Bousfield.
7. *D. furcata*, Oken (syn. *D. palpigera*, Grebnitzky;  
*D. rodriguezii*, Semper).

##### *Nais*, s. str., O. F. Müller (see woodcut).

Four cephalized segments in addition to the peristomial segment remain well marked in the fully grown head.

There is no prostomial tentacle.

Some or all of the dorsal setæ are capillary.

There are no branchial processes.

Eyes may be present or absent.

1. *N. elinguis*, O. F. Müller.

This species is common in England.

2. *N. barbata*, O. F. Müller.

This species is common in England. According to Semper<sup>1</sup> the budding zone appears after segment xvii in this species (i.e. *n*, as used on page 339, is equal to 17).

3. *N. josinæ*, Vejdovsky.

I have not seen this species.

4. *N. fusca*, Carter.

This species is recorded from India, but is not sufficiently characterised.

5. *N. scotica*, Johnston; England.

Not sufficiently characterised.

*Bohemilla*, Vejdovsky (see woodcut).

Three cephalized segments in addition to the peristomial segment remain well marked in the fully grown head.

There is no prostomial tentacle.

The capillary dorsal setæ are serrated.

There are no branchial processes.

Eyes are present in the only known species.

1. *B. comata*, Vejdovsky.

(Syn. *Nais hamata*, Timm.)

I received numerous specimens of *Bohemilla* from Mr. Bolton. It has not been, I believe, hitherto recorded from England. The specific characters agree very closely with those given by Vejdovsky and Timm. I never found a specimen without eyes; Vejdovsky makes no mention in his large book of their presence or absence, but Timm states that the eyes are not always present. I have noticed that the pigment in the alimentary canal commences in the region of the first dorsal seta bundle in this and many other species of Nais.

The nephridia are not present in all the segments. I observed nephridia in segments viii, xi, xvi, xviii, xx, and xxi, each with a funnel opening into the segment in front.

<sup>1</sup> 'Arb. zool. zoot. Institut. Wurzburg,' Bd. iv, 1877.

One of the most interesting features in the anatomy of this worm is the condition of the setæ in the cephalized segments. The first pair of ventral seta bundles, viz. those belonging to segment II, are larger than those in the two following segments. Those in segment IV are very small, and seldom contain more than two setæ—indeed, they are frequently altogether absent; but I have always found them in a newly budded head, so that when they are absent it is doubtless because they have dropped out. I have unfortunately no other notes with regard to the budding.

Ophidonais, Gervais (see woodcut).

Four cephalized segments in addition to the peristomial segment are well marked in the fully grown head.

There is no prostomial tentacle.

There are no capillary setæ.

There are no branchial processes.

Eyes are present in the only known species.

The only other known genus of Nais in which capillary setæ are absent is Paranais.

1. *O. serpentina*.

This species is well known in England; all the dorsal setæ are spear-shaped and straight.

Slavina, Vejdovsky (see woodcut).

Four cephalic segments in addition to the peristomial segment are well marked in the fully grown head.

There is no prostomial tentacle.

The dorsal setæ are capillary.

There is a girdle of papillæ in the middle of each segment.

1. *S. appendiculata*, Vejdovsky.

I received a few specimens of a species of Slavina from Mr. Bolton, but have no notes which enable me to offer an opinion as to the identity or otherwise of the English species with *S. appendiculata*, Vejdovsky.

According to Bousfield<sup>1</sup> the English species is identical with the *Nais lurida* of Timm, and he calls it *S. lurida*, and

<sup>1</sup> 'Journ. Linn. Soc. Zoology,' vol. xix, 1886, p. 264.

maintains that this species is not identical with *S. appendiculata*, as Vejdovsky believes it to be. As Stolc<sup>1</sup> has pointed out, this is very probable, and the difference is to be found in the arrangement of the tactile papillæ; but I agree with Stolc, that Bousfield has fallen into a great error in associating *Ophidonais serpentina* with the genus *Slavina*. The absence of capillary setæ distinctly marks *Ophidonais* as a separate genus.

#### *Stylaria*, Lamarek (see woodcut).

Four cephalized segments in addition to the peristomial segment are present in the bud, and remain well marked in the fully grown head.

The prostomial tentacle is very long.

The dorsal setæ are capillary.

There are no branchial processes.

Eyes are present in the only known species.

#### 1. *S. lacustris*.

A full synonymy of this species, which is perhaps most widely known as *Nais proboscidea*, is given by Vejdovsky.

I have occasionally observed specimens in which dorsal setæ were present in the one or two most posteriorly placed of the usually cephalized segments. I can only suggest that these were abnormal individuals, but it is a matter worthy of further investigation. I described the process of budding in this worm at the meeting of the British Association at Aberdeen, in 1885. I quote here the substance of the note published in the report of that meeting. I have altered the numbering of the segments to make it accord with the system adopted in the present memoir, in which the peristomial segment is called segment 1.

“When budding is about to commence, a slight thickening of one of the septa which separate one cœlomic segment from another occurs. This thickening increases, the body-wall in the region thickens, and an actual bud is here formed. This

<sup>1</sup> ‘*Zoologischer Anzeiger*,’ vol. ix, 1886, p. 502.

new region elongates, and presents a solid appearance. The alimentary canal grows in this region, but the newly formed portion is at first unpigmented, and may still be detected at a much later period by its lighter colour. Its lumen remains, however, all the time, and a continuous line of fæcal matter may be observed (Pl. XXVII, fig. 9, *fæc.*). This budding region divides into two portions. The anterior portion develops numerous setæ, and gives rise to an indefinite number of segments which form the tail of the old worm. The posterior portion develops four pairs of ventral setæ, this development taking place from before backwards; and subsequently at its anterior region the peristomial segment and the characteristic proboscis are developed, and the two individuals separate. The budding region usually forms between segments XXVII and XXVIII, so that segment XXVIII becomes segment VI of the posterior daughter worm: the five anterior segments of this worm never present dorsal setæ.”

What is described above as taking place is clearly shown in Pl. XXVII, figs. 7—9, which represent various stages of the process.

The division of the budding zone into a new tail on the one hand and a new head on the other was clearly stated by Semper,<sup>1</sup> whose paper on the subject I had not seen when writing the above.

It will be seen that, according to the nomenclature I have adopted,  $n = 26$ , and  $z'$  consists of five segments in this species.

*Pterostylarides*, Czerniavsky (see woodcut).

Four cephalized segments in addition to the peristomial segment are indicated in the fully grown worm. The two hinder of these are devoid of ventral as well as of dorsal setæ.

The prostomial tentacle is of medium length.

The dorsal setæ are capillary.

There are no branchial processes.

Eyes are present.

Vejdovsky associates this genus with *Stylaria*, but I think

<sup>1</sup> ‘*Arb. zool. zoot. Instit. Wurzburg*,’ Bd. iv, 1877.

that the peculiar character of the cephalization is a feature amply sufficient to warrant the separate genus.

*Pterostylarides* differs from all the other genera in the constant possession of cephalic segments other than the peristomial which are devoid of all setæ. It is, of course, an assumption that the region between the second and third seta-bearing segments does represent two segments. Vejdovsky in his "Oligochæta" assumes that this is the case; but I have not seen his paper on "Thierische Organismen der Zusammenwässer von Prag, &c." In Pl. XXVI, fig. 1, which was drawn from nature, there is but the very slightest external indication of segments in this region, and I made no observations upon the septa.

As stated above, in *Bohemilla comata* the setæ in the most posterior cephalized segment are few in number and very small, and may disappear; when this occurs we have an undeniable instance of a cephalized segment devoid of all setæ. Such absence of all setæ is, I think, to be regarded as extreme cephalization.<sup>1</sup>

In the following description of *P. parasita* I have selected from Vejdovsky's description what seem the important points in distinguishing this species from *P. macrochæta*.

#### 1. *P. parasita*, O. Schmidt.

Prostomial tentacle of about the same length as the peristomial segment ("Mundsegment").

The eyes are on the dorsal side.

The ventral setæ of the second and third segments are curved and crotchet-shaped, and about a third longer, and with longer teeth than the ventral setæ of the other segments. There are five or six setæ in these bundles, and seven or eight in those of the other segments.

The setæ in the three most anterior dorsal bundles are

<sup>1</sup> There can be no doubt that *Chætogaster*, which in my opinion ought to be classed with the Naidomorpha, presents a region corresponding to two or even three imperfectly developed segments devoid of setæ between the first and second pairs of bristle bundles.—E. R. L.

capillary, and longer than the first five segments. There are twelve to fifteen in the bundle. The other dorsal setæ are capillary, and of about one fifth the length of the anterior ones.

2. *P. macrochæta*, mihi (Pl. XXVI, fig. 1).

The prostomial tentacle is much longer than the peristomial segment.

Eyes as in *P. parasita*.

The ventral seta bundles of the second and third segments consist of two to three setæ, and those of the other segments of two to five setæ.

The setæ in the three most anterior dorsal bundles are all capillary; two to five of these are very long, longer even than the long setæ in *P. parasita*, while the other four to six are shorter than the other dorsal setæ. The remaining dorsal seta bundles usually contain two setæ, one rather longer than the other.

I found no individuals with generative organs, and none exhibiting gemmation.

[The long setæ are frequently found thrown forward so as to partly encase and protect the head when the worm forms for itself a temporary tube. They are also used to strike the water in swimming.—E. R. L.]

*Paranais*, Czerniavsky (see woodcut).

Three cephalized segments in addition to the peristomial segment remain well marked in the fully grown head.

There is no prostomial tentacle.

There are no capillary setæ; all the setæ (dorsal as well as ventral) are crotchet-shaped.

There are no branchial processes.

Eyes may be present or absent.

1. *P. uncinata*, Oersted.

According to Czerniavsky the *Ophidonais uncinata* of Oersted belongs to the genus *Paranais*.

2. *P. littoralis*, O. F. Müller (Pls. XXVI and XXVII, figs. 2 to 6).

This species is by no means well known. It is recorded by



Oersted, and more recently mentioned by Czerniavsky, who founded the genus *Paranais* for it and the above-mentioned species. Czerniavsky found it in Abchasia.

Professor Lankester received specimens of this worm from the great mud-banks at Sheerness, at first through Mr. Bolton; but we afterwards obtained it in quantity from Mr. W. H. Shrubsole, who found it living in enormous numbers along with *Haplobranchus* and *Hemitubifex*. It is one of the few *Oligochæta* which are known to inhabit salt water.

I am able to give only such notes of its structure as were made at the time by Professor Lankester and myself.

The prostomium is blunt and rounded.

The setæ present an arrangement the main features of which are doubtless characteristic of the genus, and are given above in the generic definition.

Setæ are absent, as is universally the case, from the peristomial segment (segment I).

In segments II, III, and IV, ventral seta bundles alone are present, while in all other segments dorsal and ventral seta bundles are present. The usual number of setæ to the bundles is as follows:

	Dorsal.							Ventral.
Segment I	.	.	.	—	.	.	.	—
„ II	.	.	.	—	.	.	.	5
„ III	.	.	.	—	.	.	.	3
„ IV	.	.	.	—	.	.	.	3
„ V	.	.	.	3	.	.	.	3
„ VI	.	.	.	3	.	.	.	3

and so on. In the dorsal bundles there are occasionally two setæ only; and in the budding region there are, as a rule, in the early stages of the bud two setæ only in each bundle, one longer than the other.

The ordinary setæ vary but little in shape throughout the body.

In no other genus of Nais have all the dorsal setæ the crotchet shape, as is here the case (Pl. XXVII, fig. 6).

In *Ophidonais* none of the dorsal setæ are capillary, but are spear-shaped setæ, and unlike the ventral setæ of that genus.

In *P. littoralis* the setæ of the cephalized segments are



longer and thinner than those which follow, and the ventral setæ of the majority of the segments are a little thicker and shorter than the dorsal setæ (Pl. XXVII, fig. 5).

Modified genital setæ are present in sexual individuals. They are the ventral setæ of segment v. There is no evidence that they represent any interpolated segment. The ordinary setæ doubtless drop out from the ventral bundles in that segment during the breeding season, and are replaced by the modified genital setæ. There are usually three in the bundle. They are very stout, and longer than the ordinary setæ, and they possess a mere rudiment of the crotchet at the free extremity.

In the budding individual the arrangement of the setæ in a well-advanced bud is shown in Pl. XXVI, fig. 2. In the new tail the series of seta bundles are seen to fade away gradually as one passes backwards—that is to say, the most posterior bundle is the youngest. In the new head there are three pairs of ventral seta bundles, only the new head assumes from the first its adult character (compare this with *Pristina*).

The pharynx occupies about three segments, and at its sides and posterior to it occur two large glandular masses (Pls. XXVI, XXVII, figs. 2 and 3, *ph. gl.*), which are possibly groups of unicellular salivary glands. The “stomach” is well marked, and lies in segment VIII; the intestine is narrow in the following segment, and then widens out.

The dorsal and ventral vessels are clearly defined throughout the whole length of the worm. They communicate with one another by three pairs of branching lateral vessels in segments II to IV, and by three pairs of larger unbranched “hearts” in segments V to VII.

It is exceedingly interesting to note that in the newly budded regions and other regions of active growth, as in all tail regions, the dorsal and ventral vessels are joined by commissural vessels in every segment, and that this is therefore doubtless the primitive arrangement; and the suppression of the commissural vessels in all except certain anterior segments indicates a particular kind of cephalization (Pl. XXVI, fig. 2).

I was unable, even after repeated examination, to discover

any nephridia ; and their absence, if they are really absent, is a very remarkable character, which I should be glad to see verified.

I found numerous individuals in which the generative organs were well developed (Pl. XXVII, fig. 3).

The testes occur in segments VIII and IX, and the ovaries in segment X.

The spermathecae lie in segment V, and open near the modified genital setae, between segments V and VI.

I was able to make a few observations on the asexual reproduction.

The most complicated chain of zooids which I obtained exhibited two regions of active growth. Such a chain would be represented, according to the nomenclature which I adopt, thus:—BC, or BC, or  $c^1c^2$ , &c. According to the same nomenclature,  $n = 17$  in *P. littoralis*, and  $z'$  consists of four segments.

#### *Pristina*, Ehrenberg (see woodcut).

Seven cephalized segments—of which only one, the peristomial segment, is recognisable in the fully grown head region—may be distinguished in the newly budded head region.

The prostomial tentacle is short.

The dorsal setae are capillary or capillary and spear-shaped.

Branchial processes are absent.

Eyes are absent in all the known species.

#### 1. *P. longiseta*, Ehrenberg.

This species has been recently re-described by Vejdovsky. I have not seen it, nor has it, so far as I know, ever been recorded from England.

#### 2. *P. equiseta*, sp. n.

I found this species in great quantity in the Victoria regia tank in the gardens of the Royal Botanic Society at Regent's Park, London.

It differs from *P. longiseta* only in the non-development of the long setae to which that species owes its name.

It is very small, about 8 mm. long.

The majority of my specimens in which there were no generative organs, and which were not budding, consisted of eighteen to twenty-one segments.

I frequently found the ventral setæ of the fourth segment in non-budding individuals to be much larger and stouter than the other ventral setæ. These were probably modified genital setæ, but I never obtained specimens showing any further sexual developments. The dorsal setæ are all capillary and of similar lengths throughout the body. There are usually two in the bundle, one longer than the other; but those of the third segment are not extra long, as is the case in *P. longiseta*.

The "stomach" lies in segment VIII.

The blood is yellowish.

I observed a single pair only, of commissural vessels.

The most anterior nephridia lie in segment IX, and not in segment X, as in *P. longiseta*.

The cœlomic corpuscles are very large, and greenish in colour.

I observed numerous budding individuals, but in all cases there was only a single budding region in any particular specimen, from which I infer (though not with certainty) that as soon as a chain of two zooids is formed a separation takes place.

The budding takes place after segment XIII (i.e.  $n = 13$ ), and there are seven segments in the new head (i.e.  $z'$  consists of seven segments). The most anterior of these becomes the peristomial segment, and the remaining six develop dorsal and ventral setæ; so that in the adult they are indistinguishable, so far as the setæ are concerned, from those which follow.

### 3. *P. breviseta*, sp. n. (Pl. XXVII, figs. 11—15).

This is a species which I found in enormous numbers in one or two localities in Madras; and although I hope to describe it and other Indian Naids in detail at some future date, I refer to it now because, from observations made upon it, I have been enabled to verify the law of budding described in the foregoing portion of these notes.

*P. breviseta* grows to a larger size than the other species of *Pristina*, and contains a greater number of segments, and differs from them besides in two or three well-marked characters.

The dorsal setæ are of two kinds (Pl. XXVII, figs. 14 and 15), capillary setæ and spear-shaped setæ: the latter are peculiarly shaped, and are bifurcated at the distal extremity. (Compare with these Vejdovsky's figures of the dorsal setæ in *Naidium luteum*, and those figured by myself for *Chætobranchus*).

The capillary setæ are of about the same length throughout the body, except that in the second and third segments they are shorter (this is the character referred to by the name of the species).

Those of segment II are about half, and those of segment III about three quarters as long as those that follow.

The cœlomic corpuscles are black and very noticeable.

The most anterior nephridia are in segment IX.

I have not hitherto found sexual individuals. The budding takes place, as a rule, after segment XXII (i.e.  $n = 22$ ), and the newly budded head consists, as in *P. equiseta*, of seven segments (i.e.  $z'$  consists of seven segments in the genus *Pristina*). (See Pl. XXVII, fig. 12.) It has been largely the comparison of these two species of *Pristina* which has led me to believe that, as stated on p. 338,  $n$  is constant (with a few individual variations) for the species, while the number of segments in the new budded head is constant in the genus.

I give below a few examples, selected from the very large number of specimens in which I have counted the segments.

1. More than thirty segments, no budding.
2. More than forty segments, no budding.
3. More than forty-six segments, no budding.
4. More than fifty segments, with a budding zone after segment XX.
5. More than fifty-five segments, with a budding zone after segment XXII.
6. More than fifty-six segments, with a budding zone after segment XXII.

7. More than seventy-one segments, with a budding zone after segment XXII.
8. More than seventy-eight segments, with a budding zone after segment XXII, and another budding zone after the eighteenth segment beyond the new head of the anterior budding zone.

I say "more than" so many segments in all these cases because it is impossible to count the actual number of segments in the tail region.

*P. inequalis*, Ehrenberg, is insufficiently characterised, and *P. flagellum*, Leidy, does not belong, according to Vejdovsky, to the genus *Pristina*, but comes somewhere between *Dero* and *Aulophorus*.

#### *Naidium*, O. Schmidt (see woodcut).

One cephalized segment only recognisable in the fully grown worm, and no information as to the bud.

There is no prostomial tentacle.

The dorsal setæ are capillary and spear-shaped.

There are no branchial processes.

Eyes absent in the only known species.

#### 1. *N. luteum*, O. Schmidt.

#### *Chætobranchnus*, mihi (see woodcut).

One cephalized segment only, recognisable in the fully grown worm, and insufficient information as to the bud.

There is no prostomial tentacle.

The dorsal setæ are capillary and spear-shaped. Branchial processes enclosing some or all of the setæ of the dorsal bundles present in all the anterior segments, with the exception of the peristomial segment.

In the shape and arrangement of the setæ this genus very closely approaches *Naidium*, from which genus it differs in the remarkable branchial processes.

#### 1. *C. semperi*, mihi.<sup>1</sup>

<sup>1</sup> 'Quart. Journ. Micr. Sci.,' vol. xxxi, 1890.

## DESCRIPTION OF PLATES XXVI &amp; XXVII,

Illustrating Professor Alfred Gibbs Bourne's "Notes on the Naidiform Oligochæta," &c.

## PLATE XXVI.

FIG. 1.—Surface view of *Pterostylarides macrochæta*. The segments are numbered 1—28. *m.* Mouth.

FIG. 2.—View of *Paranais littoralis*. The Arabic numerals indicate segments of the parent worm; the Roman numerals are attached to segments in the budding zone. *m.* Mouth. *ph.* Pharynx. *ph. gl.* Pharyngeal glands. *st.* Stomach. *d. v.* Dorsal vessel. *v. v.* Ventral vessel. *int.* Intestine. *n.* Nerve-cord.

## PLATE XXVII.

FIG. 3.—Anterior extremity of a sexual individual of *Paranais littoralis*. *ph. gl.* Pharyngeal glands. *gen. set.* Genital seta bundles. *sp.* Spermatheca. *t.* Testis. *ov.* Ovary.

FIG. 4.—Ventral seta from segment II, III, or IV, of *Paranais littoralis*.

FIG. 5.—Modified genital seta of *Paranais littoralis*.

FIG. 6.—Dorsal seta from *Paranais littoralis*.

FIGS. 7, 8, and 9.—Views of the budding zone in *Stylaria lacustris* in successive stages of growth. *Z.* Budding zone. *z.* Newly budded tail. *z'.* Newly budded head. *pr.* New prostomial tentacle. The Arabic numerals indicate segments of the parent worm; the Roman numerals indicate newly budded segments. *Fæc.* Fæces, showing how they pass through the newly budded region.

FIG. 10.—Enlarged view of the seta bundles of one side of the new head, from the same specimen as Fig. 9.

FIG. 11.—Diagram of the anterior extremity of *Pristina breviseta*.

FIG. 12.—Diagram of the budding zone of *Pristina breviseta*. Letters and numerals as in Fig. 9. The animal is drawn from the side to show the dorsal and ventral seta bundles.

FIG. 13.—Ventral seta of *Pristina breviseta*.

FIGS. 14 and 15.—Capillary and spear-shaped dorsal setæ of *Pristina breviseta*.